

CHEMICAL PROCESSING OF NON-CROP PLANTS FOR JET FUEL BLENDS PRODUCTION

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The use of Biofuels has been gaining in popularity over the past few years due to their ability to reduce the dependence on fossil fuels. Biofuels as a renewable energy source can be a viable option for sustaining long-term energy needs if they are managed efficiently. We describe our initial efforts to exploit algae, halophytes and other non-crop plants to produce synthetics for fuel blends that can potentially be used as fuels for aviation and non-aerospace applications. Our efforts have been dedicated to crafting efficient extraction and refining processes in order to extract constituents from the plant material with the ultimate goal of determining the feasibility of producing biomass-based jet fuel from the refined extract. Two extraction methods have been developed based on communiton processes, and liquid-solid extraction techniques. Refining procedures such as chlorophyll removal and transesterification of triglycerides have been performed. Gas chromatography in tandem with mass spectroscopy is currently being utilized in order to qualitatively determine the individual components of the refined extract. We also briefly discuss and compare alternative methods to extract fuel-blending agents from alternative biofuels sources.

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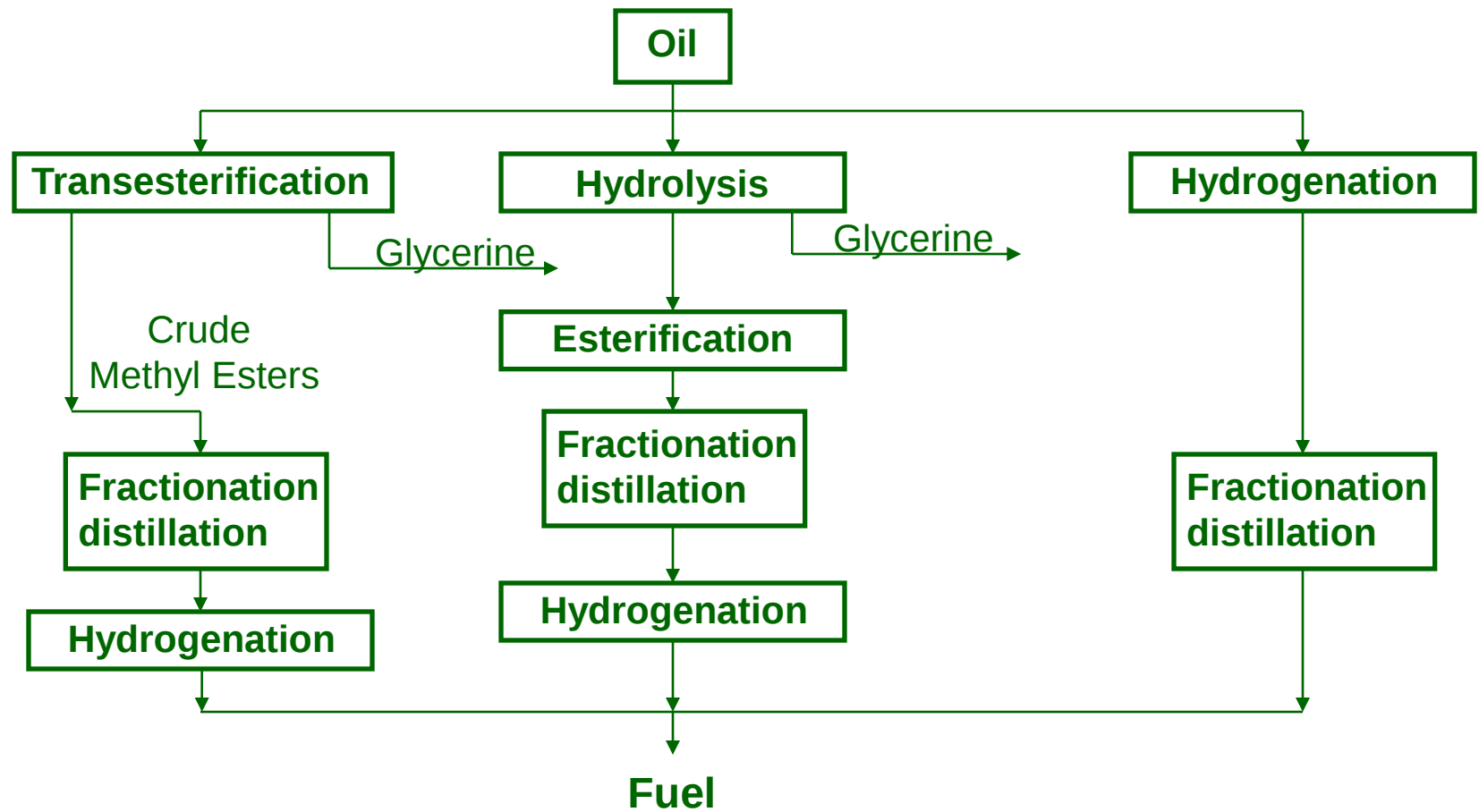
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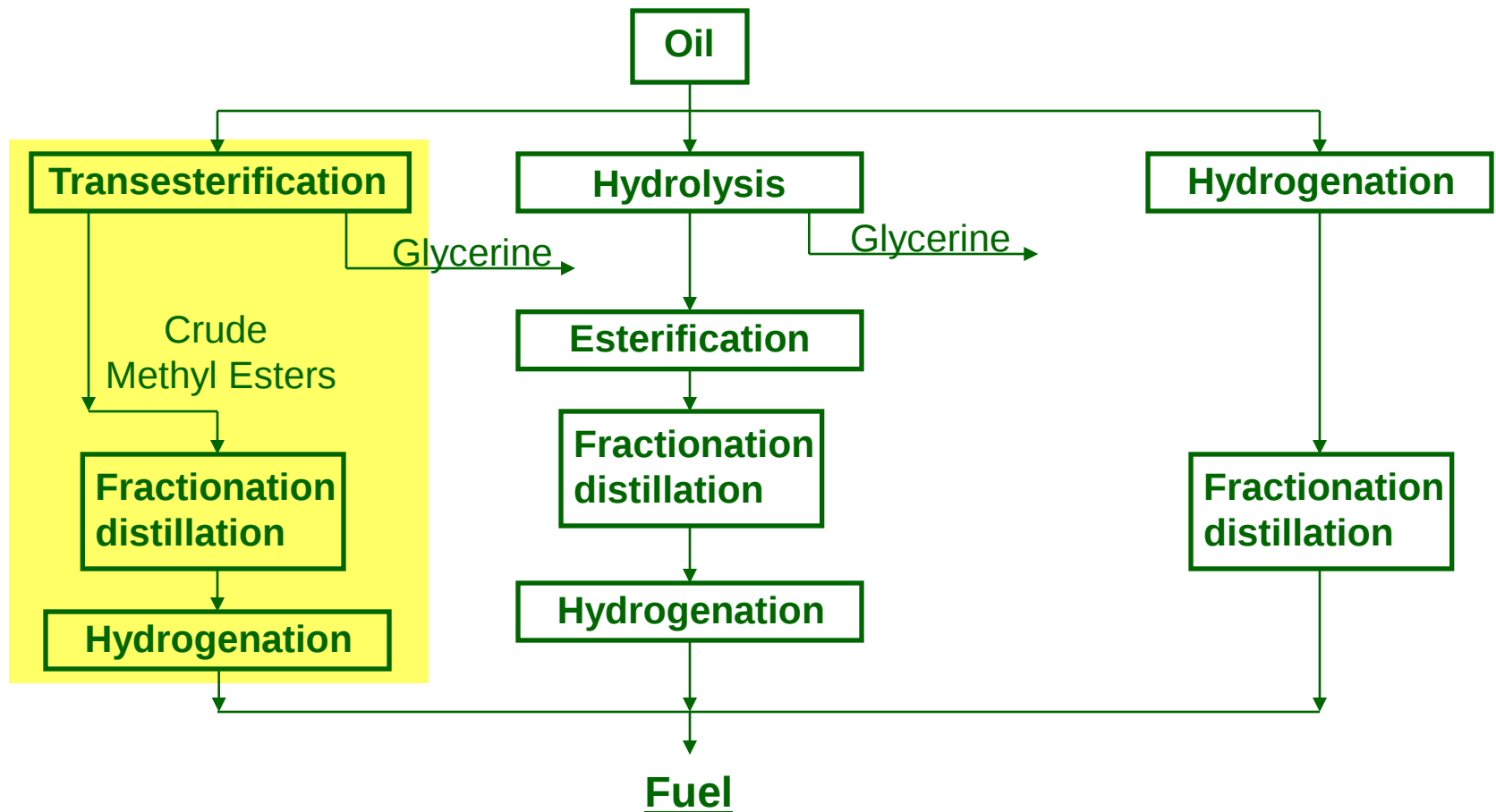
Objective

- To determine the feasibility of producing jet fuel (C8-C16) from biomass (oils)

Manufacturing of Fuel



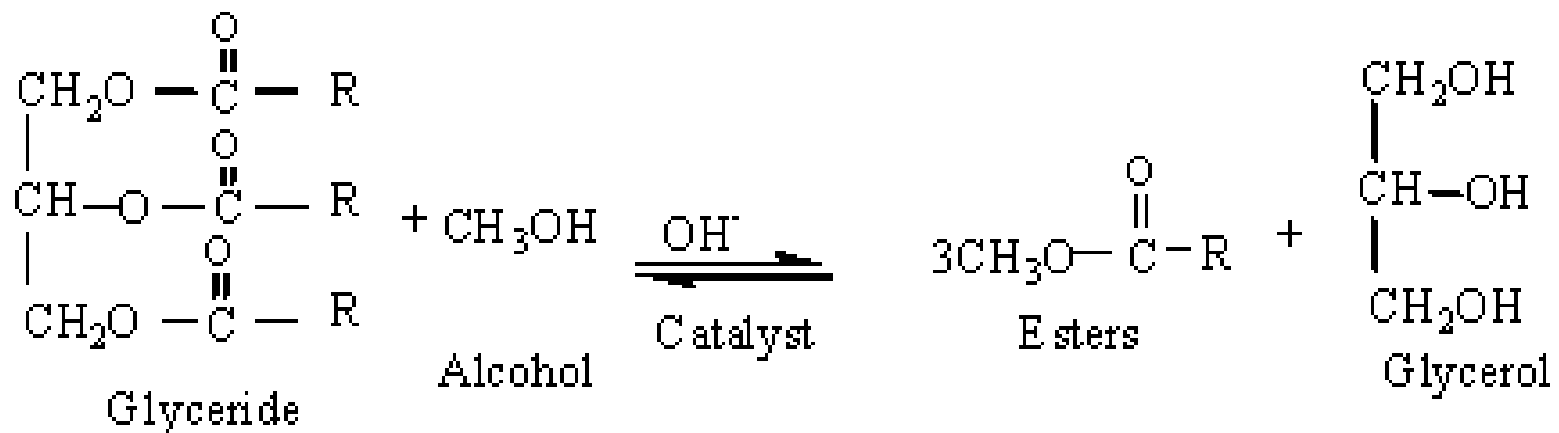
Manufacturing of Fuel



Advantages of Methyl Esters

- Lower energy consumption
- Less expensive equipment
- Easier to distill-fractionate
- GC Analysis

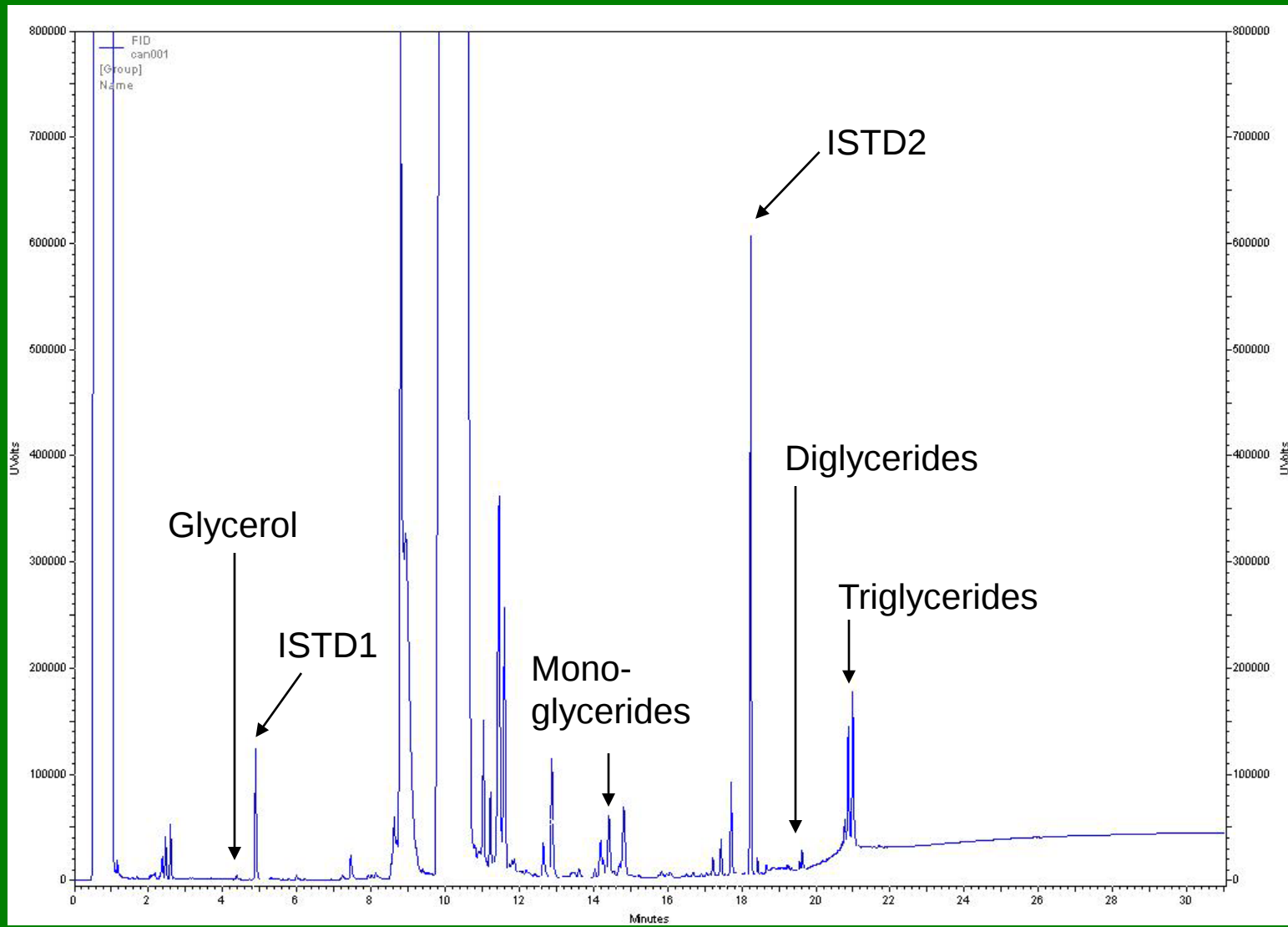
Transesterification



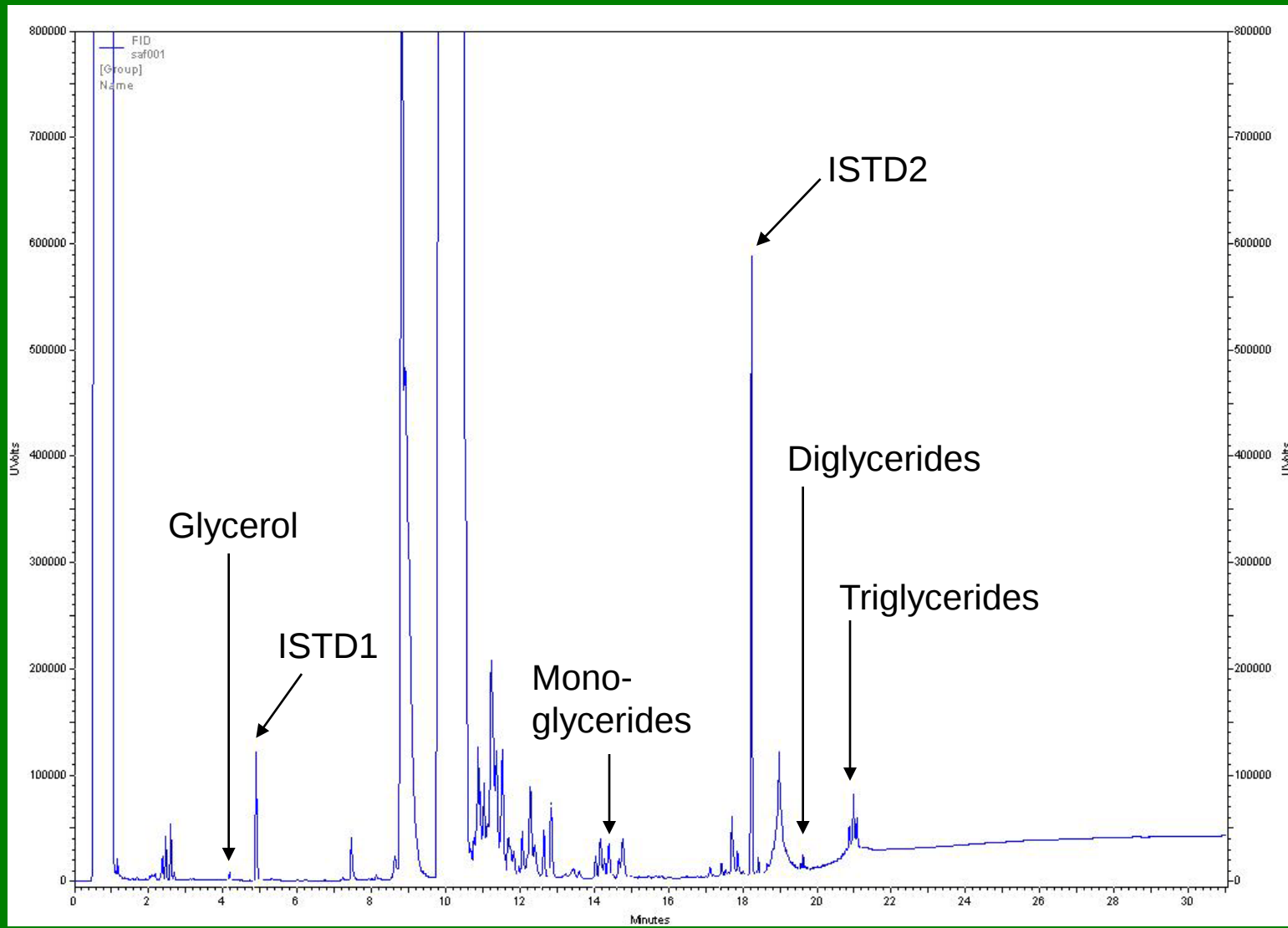
Methyl Ester from Vegetable Oils

- Canola Oil – large quantity of monounsaturated fatty acid chains
- Safflower Oil – large quantity of polyunsaturated fatty acid chains
- Coconut Oil – mostly unsaturated

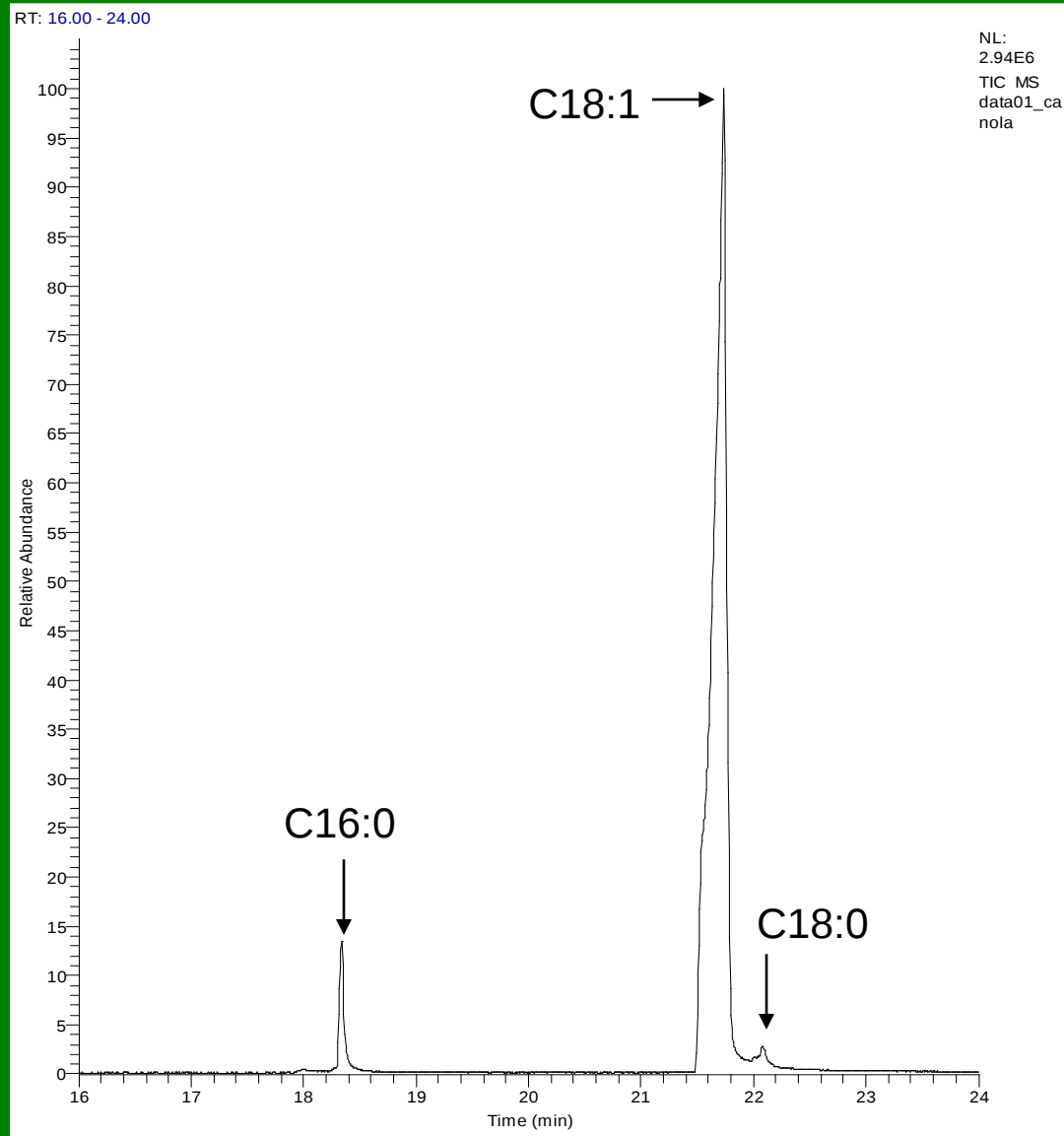
Gas Chromatography of Biodiesel (Canola)



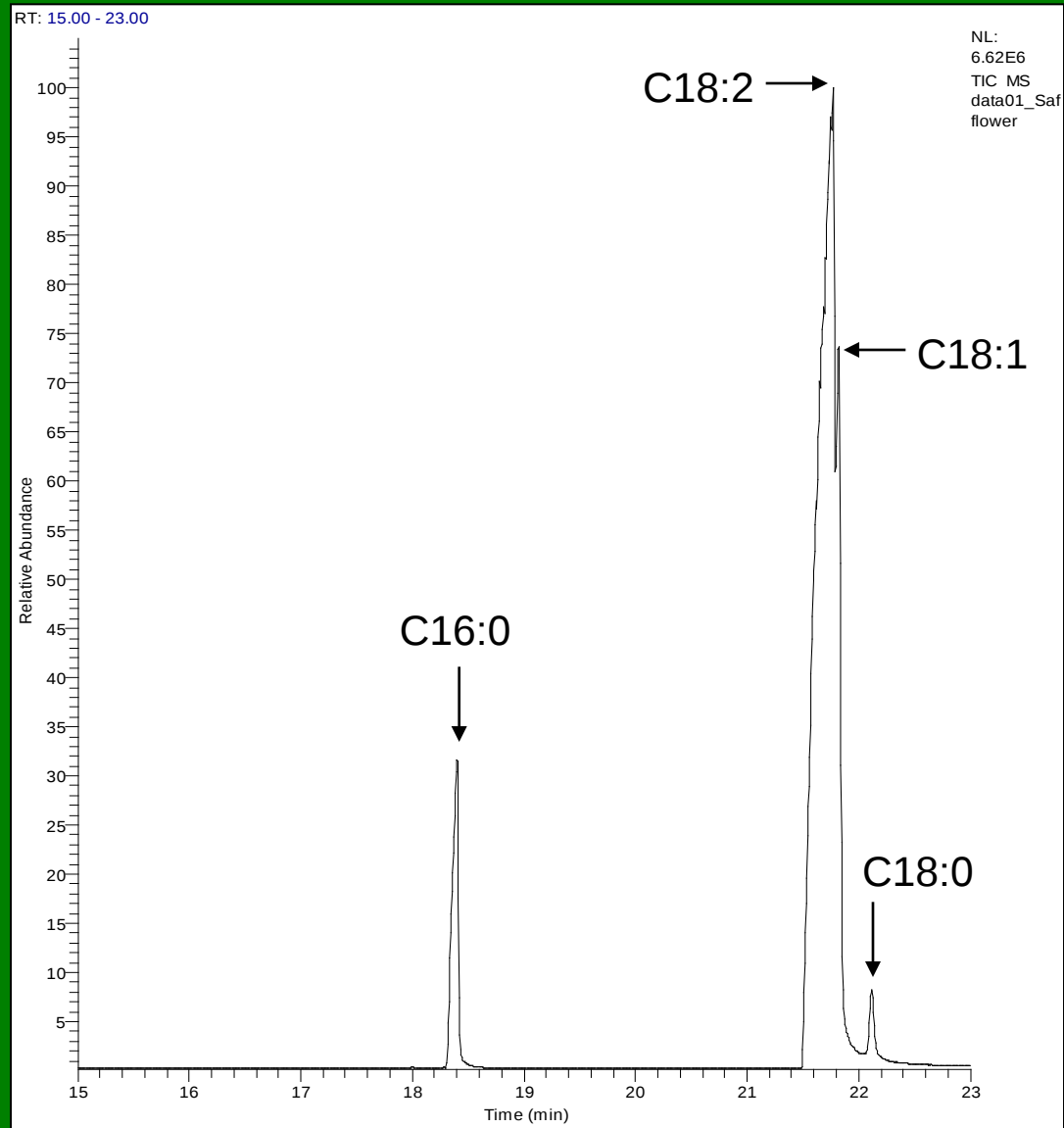
Gas Chromatography of Biodiesel (Safflower)



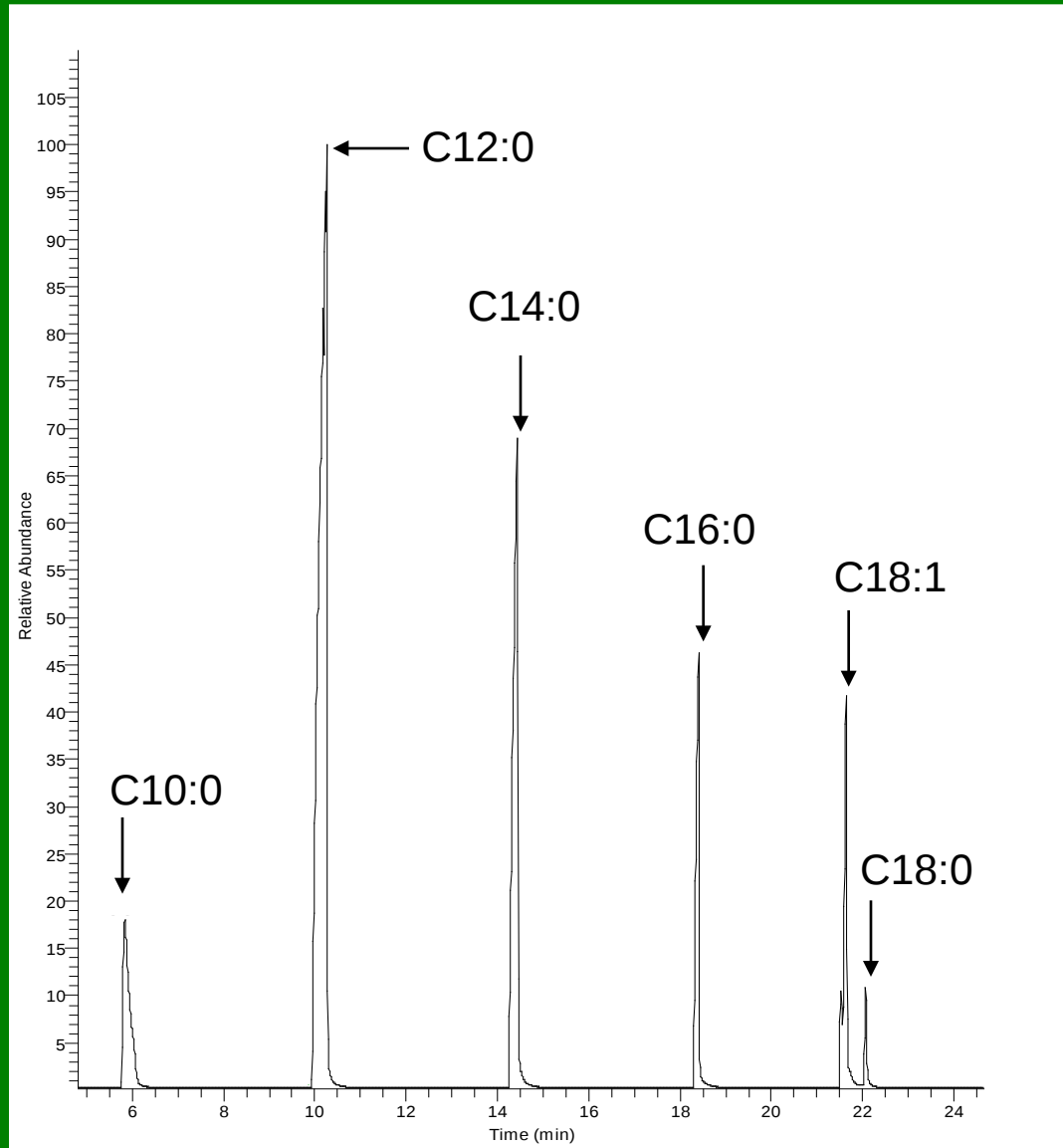
GC/MS Biodiesel (Canola)



GC/MS Biodiesel (Safflower)



GC/MS Biodiesel (Coconut)



Research

- Feedstock – Halophytes and Algae
- Catalyst – future investigations
- Protocols – optimizing methods

Methods

Method 1	Method 2
Freezing	Freezing/Drying
Comminution	Comminution/Extraction
Drying (dry weight)	Filtration
Extraction (soxlet)	Drying
Drying	

Results

Plant Material	% Extracted	Solvent
<i>Sinapis</i> (Mustard Plant)	15.78	Hexanes
Tank Algae (unknown species)	8.56	Hexanes
<i>Salicornia bigelovii</i> <i>europa</i>	3.48	Isopropanol/Hexanes
<i>Salicornia bigelovii</i> <i>europa</i> (germinating)	7.03	Isopropanol/Hexanes

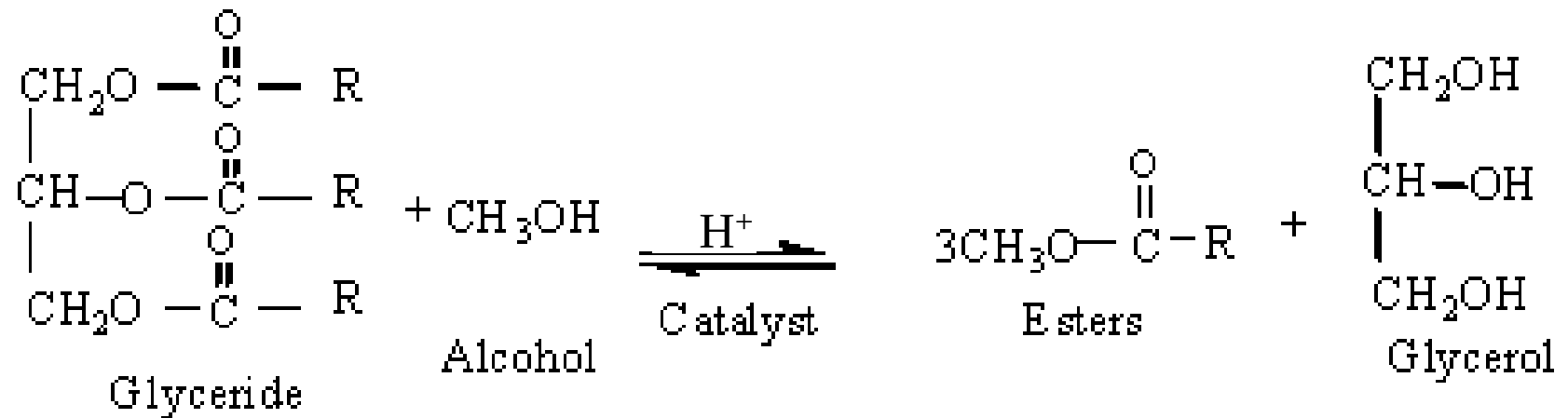
Extracted and Non-Extracted Material



Chlorophyll Removal

- Dissolve in low molecular weight alcohols/water
- Column packed with bleaching clay
- Treatment with mineral acids

Transesterification



Summary

- Conversion of vegetable oils into methyl ester
- Conversion methyl ester into jet fuel
- Extraction of lipids from halophytes and algae